Percent of Stream and Shoreline with 15% or More Impervious Cover within 30 Meters

This EnviroAtlas national map estimates within each 12-digit hydrologic unit (HUC) the percentage of stream and waterbody shoreline lengths with 15% or more impervious cover within 30 meters. It is based on the National Land Cover Database (NLCD) 2011 impervious cover data.

Why is impervious cover important?

Impervious cover is the portion of the earth's surface that is paved or otherwise covered with man-made materials (e.g., parking lots and rooftops). Such surfaces prevent water (precipitation) from infiltrating into the ground, which leads to excess runoff to streams and water bodies. Greater volumes of storm water runoff, decreased base flow volumes (water in streams between storm events), increased pollutant loads, degraded streamside habitat, and lost biological diversity have all been linked to increases in impervious cover.

Water quality tends to decline as the percentage of impervious cover in a watershed increases. When impervious surfaces reach 10–20% of local watershed area, surface runoff doubles and continues to increase until, at 100% impervious surface coverage, runoff is five times that of a forested watershed.[1,2] Excessive stormwater runoff also increases the potential for flooding.

Pollutants from multiple sources accumulate on roads and parking lots until runoff from a precipitation event carries sediment, nutrients, metals, and pesticides into stormwater drains and directly to local waterbodies. Excess nitrogen in runoff contributes excess nutrients to waterbodies, creating algal blooms and abundant aquatic plant growth (eutrophication). The breakdown of these aquatic plants can create an oxygen deficit that negatively affects the health and productivity of aquatic animal species. Sediment and suspended solids reduce water clarity and light penetration, smother or hinder the growth of beneficial aquatic plant life, and bury gravel or cobble habitats in stream beds that are essential for the sustainability of aquatic insects and fish spawning sites.

Impervious cover is most often expressed as a percentage of watershed area. Adverse impacts to stream hydrology, channel morphology, water quality, and stream ecology are

not uncommon at very low percentages (≤ 5%) of watershed impervious cover.[3] For this map, impervious cover is expressed relative to its proximity to streams and water body shorelines (within 30 meters). Impervious cover that is close to aquatic resources may be more likely to expose those resources to adverse impacts than when it is farther away. Impervious cover near aquatic resources often leads to higher pollutant loads, greater streamside habitat degradation, losses in aquatic biota, higher storm runoff, and lower base flows. Poor water quality can also affect aesthetic enjoyment, recreational opportunities, and the potential development for tourism or fishing.

How can I use this information?

The map, Percent of Stream and Shoreline with 15 Percent or More Impervious Cover within 30 Meters, provides baseline information on the total length of aquatic resource shorelines that are adjacent to impervious cover. When impervious cover in a watershed reaches approximately 15%, adverse impacts are nearly unavoidable.[3]

The map can be used to compare watersheds across a region according to the amount of stream and shorelines near impervious cover. Those watersheds with a high percentage of streams and shorelines with 15% or more impervious cover directly adjacent may be at risk for more adverse effects. This indicator can also be used in conjunction with a map of impervious cover across an entire watershed to uncover spatial patterns to provide information relevant to

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watershed planning and management. The spatial pattern of impervious cover can be used to determine if a watershed's impervious cover is proximally distributed (tends to occur near streams), distally distributed (tends to occur far from streams) or uniformly distributed (evenly spread throughout the watershed).In a nationwide (continental only) assessment, we found that 27% of the watersheds had proximally distributed impervious cover.[4]

How were the data for this map created?

This indicator is based on NLCD 2011 impervious cover data and version 2 of the 1:100,000-scale digital hydrography data from the National Hydrography Dataset (NHD). The NLCD impervious cover data are resolved at the native Landsat TM resolution of 30-x-30 meters. Each pixel is classified as 0% to 100% impervious cover in 1% increments. The adjacency aspect of the indicator was estimated by aggregating the NLCD impervious cover data into 5 classes (0%, 1%-4%, 5%-14%, 15%-24%, and ≥ 25%), creating separate maps for each of the classes, and expanding the individual, class-specific (e.g., 5%-14%) maps by 1 pixel. The individual, class-specific maps were then re-combined with the original NLCD impervious cover data to determine the extent to which streams and water body shorelines were adjacent to impervious cover. Adjacency of streams and impervious cover was estimated by the tabular intersection of the NHD and the processed NLCD impervious cover data.

What are the limitations of these data?

No data are free from measurement and other sources of error and are therefore inherently imperfect. Based on a comparison to very high resolution data (e.g., 1m-x-1m), a national assessment found that NLCD 2001 impervious cover data had a small but consistent tendency to underestimate impervious cover.[5] These results suggest that actual impervious cover in a watershed and near streams may be higher than estimated by NLCD. Similar comparisons have not been made with the NLCD 2011 impervious cover data. Field-based studies over limited areas have found also that the NHD 1:100,000 scale data probably underestimate the number of streams across an area, with a tendency to omit ephemeral streams.[6]

How can I access these data?

EnviroAtlas data can be viewed in the Interactive Map, accessed through web services, or downloaded. The 2011 NLCD Percent Developed Impervious Surface Layer is available at the MRLC website.

Where can I get more information?

There are numerous resources on the relationships between aquatic condition and impervious cover, some of which are listed below. For additional information on how the data were created or their limitations, access the metadata for the data layer. To ask specific questions about these data, please contact the EnviroAtlas Team.

Acknowledgments

The data layer and fact sheet were produced by James Wickham, EPA.

Selected Publications

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